

APPARATUS FOR CONNECTING COMMUNICATIONS DEVICES TO A MOBILE COMMUNICATIONS NETWORK USING A MOBILE TELEPHONE

5 BACKGROUND OF THE INVENTION

I. Field of the Invention

10 The present invention relates generally to telecommunication systems, and more particularly to connecting analog communications devices to a mobile communications network using a mobile telephone to emulate wireline communications services.

15 II. Related Art

The Information Age has ushered in a era of inter-connectivity that could not have been imagined a generation ago. In the near future people will be able to place phone calls and access the Internet in even the most remote regions of
20 the world. The impact of this global inter-connectivity in terms of increased productivity cannot be measured. Developing countries in particular recognize the strong positive correlation between telephone market penetration and per capita gross domestic product.

Today, mobile telephone service is available in many parts of the world.
25 The spread of mobile telephone coverage has, in fact, out paced the spread of wireline service in many developing countries and in many rural areas within developed countries. Users in these areas can often get a mobile telephone before they can be connected into the wireline network. Telephone service providers would like to offer to these users all the functionality of wireline
30 service. For example, typical wireline service allows for the connection of many communications devices, such as multiple phones, fax machines, and computer modems. A need therefore exists for an improved apparatus for connecting these communications devices to a mobile communications network using a mobile telephone.

35 Even in those areas where wireline infrastructure exists, oftentimes it is prohibitively expensive or physically difficult to install multiple lines. Here again, an improved apparatus for connecting communications devices to a

mobile communications network using a mobile telephone can provide a more convenient and less costly means of adding additional telephone lines.

A different problem often exists in highly developed areas where a single user might subscribe to multiple communications services. For example, one person might subscribe to a first provider for mobile service, a second provider for home wireline service, and a third provider for business wireline service. The end result is that a single person might have several telephone numbers where they can be reached at different times of the day. Many users would prefer to have a single telephone number where they could be reached at any time of the day. The telephone number associated with the mobile telephone would provide a convenient single number. However, conventional mobile telephone service does not allow for the easy connection of communications devices when at a fixed location, such as at home or at work. An improved apparatus for connecting communications devices to a mobile communications network using a mobile telephone would also meet the needs of those users desiring a single telephone number.

SUMMARY OF THE INVENTION

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Briefly stated, the present invention is directed to an apparatus for connecting communications devices to a mobile communications network using a mobile telephone. A serial interface couples the mobile telephone to BORSCHT means that provides BORSCHT functionality. BORSCHT (Battery, Overvoltage, Ringing, Supervision, Hybrid) functionality refers to those functions typically provided to a communications device by the central station of a wireline service provider. A two-wire line port couples the BORSCHT means to an analog communications device, such as a standard telephone, referred to herein as a "plain old telephone" (POT), a fax machine, or a computer modem. Conversion means, coupled between the two-wire line port and the serial interface, converts the digital signals from the mobile telephone into analog two-wire line signals, and vice versa. The present invention allows a communications device to place or receive a call over the mobile communications network, using the mobile telephone's radio unit to establish a wireless connection, in the same manner as if the communications device were connected to a wireline service.

A feature of the present invention is that a mobile telephone can be used to provide wireline-like functionality in areas where wireline service is unavailable or cost prohibitive. Communications devices designed to operate over a wireline network communicate via a two-wire line port. The present invention allows these devices to access a mobile communications network in the same manner they would if connected to a wireline network. The present invention can provide connections to multiple telephones in a home or business, that appear to the user to operate as though they were connected to a wireline service. For example, a dial tone is provided when the handset is picked up, and a call is connected automatically after the appropriate number of digits have been entered—functions typically associated with wireline service but not associated with many mobile telephones.

An advantage of the present invention is that wireline-like service can be provided on a temporary basis to areas, such as new housing developments, where telephone lines are being installed but are not yet active. In a preferred embodiment, the present invention includes a docking unit and a mobile telephone. Combining, or "docking", the mobile telephone with the docking unit activates the attached communications devices. However, the user is free to remove the mobile telephone and use it like any other mobile telephone when away from the docking unit. From a marketing perspective, many users who do not already have a mobile telephone might be enticed to become mobile subscribers once they experience the advantages of mobile telephone use. The docking unit can be removed once wireline services become available, but for those desiring to enter into a mobile subscriber agreement, the mobile telephone can be left behind. The present invention therefore allows a telephone provider to leverage wireline services to capture new, higher-margin mobile telephone subscribers.

Another feature of the present invention is that multiple and varied communications devices can be connected to a mobile communications network using a single mobile telephone. For example, the present invention when placed in a home can provide wireline-like connections for a fax machine, a computer modem, and multiple POTs.

Another advantage of the present invention is that one-person-one-telephone number service can be conveniently provided. The mobile telephone can be used in normal fashion for conventional mobile applications, for

example, while driving in the car. The mobile telephone can then be docked with the docking unit to "activate" the attached communications devices. Such a docking unit can be used wherever wireline services would typically be used, such as in a home or business. Now, however, since all calls are routed through the mobile telephone, the user can always be reached at the same telephone number.

Another advantage of the present invention is that the functionality of the mobile telephone is used in conjunction with the functionality provided by the BORSCHT means in the docking unit to provide the desired connection to the mobile communications network. Those functions provided by the mobile telephone do not need to be replicated in the BORSCHT means, which results in a cheaper, smaller, less complex docking unit. Design time of the docking unit is also reduced because those functions provided by the mobile telephone do not have to be re-designed in the docking unit. These advantages become increasingly apparent as mobile telephones become more sophisticated and include greater functionality.

BRIEF DESCRIPTION OF THE FIGURES

Further features and advantages of the invention, as well as the structure and operation of various embodiments of the invention, are described in detail below with reference to the accompanying drawings. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. The drawing in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number.

FIG. 1 depicts a docking unit, a mobile telephone, a mobile communications network and communications devices; and

FIG. 2 depicts a more detailed view of the docking unit and the mobile telephone.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Overview of the Invention

5 The present invention is directed to an apparatus for connecting communications devices to a mobile communications network using a mobile telephone. A serial interface couples the mobile telephone to BORSCHT means that provides BORSCHT functionality. A two-wire line port couples the
10 BORSCHT means to an analog communications device, such as a POT, a fax machine, or a computer modem. Conversion means, coupled between the two-wire line port and the serial interface, converts the digital signals from the mobile telephone into two-wire line signals, and vice versa. The present invention allows a communications device to place or receive a call over the
15 mobile communications network, using the mobile telephone's radio unit to establish a wireless connection, in the same manner as if the communications device were connected to a wireline service.

FIG. 1 depicts a communications environment 100 within which the present invention is used. A docking unit 102 is coupled to a mobile telephone
20 104. Mobile telephone 104 communicates with a mobile communications network 106 via a wireless link 108. One or more communications devices 110A, B, ..., N are coupled to docking unit 102 via a two-wire line port 116 and a two-wire line 118. FIG. 1 depicts an example embodiment including two-wire line ports 116A, B, ..., N and two-wire lines 118A, B, ..., N connecting docking
25 unit 102 to communications devices 110. Mobile telephone 104 is docked with docking unit 102 by coupling a mobile telephone serial port 114 with a docking unit serial port 112.

The combination of mobile telephone 104 docked with docking unit 102 provides wireline-like functionality to communications devices 110. The two-
30 wire line that would be plugged into a wireline wall socket is plugged into a two-wire line port 116 in docking unit 102. The combination of mobile telephone 104 and docking unit 102 provides all the functionality one would expect from wireline service, including, but not limited to, a dial tone, automatic/immediate "send" to eliminate the need for a SEND command after
35 digits are dialed (referred to herein as call origination), and lighting the telephone keypad. Wireline functionality is referred to collectively within the

art as BORSCHT functionality, and describes the "look and feel" of wireline telephone service.

In a preferred embodiment, mobile telephone 104 provides some BORSCHT functionality, and also provides the radio and antenna necessary to communicate with mobile communications network 106 via wireless link 108. Docking unit 102 provides the necessary interfaces/ports between mobile telephone 104 and communications devices 110, as well as whatever BORSCHT functionality is not provided by mobile telephone 104.

Docking unit 102 is preferably built to match a particular mobile telephone 104, or with a particular family of mobile telephones 104 that share certain functionality, in the sense that docking unit 102 preferably provides whatever BORSCHT functionality is not provided by mobile telephone 104. As mobile telephones 104 become more sophisticated and provide greater BORSCHT functionality, docking unit 102 can become less sophisticated, less expensive, and more compact. This design allows for the maximum leveraging of the functionality of sophisticated mobile telephones.

Docking unit 102 can also provide a charging interface for charging the mobile telephone's battery, a standard AC adapter, an external antenna jack (for improved reception), and an RS-232 data port for connecting digital communication devices.

Mobile communications network 106 is preferably an IS-95 code division multiple access (CDMA) wireless network, and wireless link 108 represents an appropriate CDMA modulated signal transmitted over the air. It will be apparent to those skilled in the art that the present invention will be operable with other wireless communications systems, such as time division multiple access (TDMA), GSM, etc., systems.

In this preferred embodiment, mobile telephone 104 must therefore be capable of transmitting and receiving the CDMA modulated signals used by mobile communications network 106. Those skilled in the art sometimes refer to wireless networks that provide services to fixed installations as wireless local loop (WLL) networks. In other alternative embodiments, mobile communications network 106 can represent any digital wireless network. In these embodiments, mobile telephone 104 transmits signals over wireless link 108 according the particular modulation scheme expected by mobile communications network 106.

Communications device 110 can represent any analog device known to those skilled in the art that transmits information over a wireline network via a two-wire line. For example, communications device 110 can represent a POT, a fax machine, or a data modem. Those skilled in the art will recognize that many other communications devices 110 are possible. Since docking unit 102 provides wireline-like functionality to those devices connected to two-wire ports 116, communications devices designed to be plugged into a wireline network can be used with docking unit 102 to make phone calls without requiring any modifications or a special interface.

Mobile telephone serial port 114 and docking unit serial port 112 represent standard serial port connections well known to those skilled in the art. Two-wire port 116 represents a standard connector for two-wire telephone lines, such as an RJ-11 port. Note that FIG. 1 depicts multiple two-wire ports 116, one for each communications device 110. In a preferred embodiment, these ports are all accessed via a common telephone number, analogous to a home having a single telephone line but having multiple RJ-11 ports throughout the house all accessed by the same telephone number. In an alternative embodiment, docking unit 102 has a single two-wire port 116. A port extender could then be used to attach multiple communications devices 110, but would effectively operate in the same manner as the preferred embodiment.

Mobile Telephone Not Docked - Inactive State

When mobile telephone 104 is not docked with docking unit 102 (that is, when mobile telephone serial port 114 is not coupled with docking unit serial port 112), docking unit 102 remains in an inactive state. Without the radio transmitter of mobile telephone 104, docking unit 102 has no way of communicating with mobile communications network 106.

Mobile Telephone Docked with Docking Unit

When mobile telephone 104 is docked with docking unit 102 (that is, when mobile telephone serial port 114 is coupled with docking unit serial port 112), docking unit 102 remains in an active state. Mobile telephone 104 does not ring in the active state when incoming calls are received from mobile communications network 106. Rather, the incoming call is passed along to

communications devices 110, just as though they were attached to a single line for wireline service. For example, assume that communications devices 110A, B, ..., N represent POTs. When mobile telephone 104 receives an incoming call from mobile communications network 106, all three of the POTs ring and any or
5 all may answer the call.

Similarly, any communications device 110 attached to docking unit 102 may originate a call (so long as another communications device 110 attached to the same docking unit 102 is not in the midst of an existing call) while mobile telephone 104 is docked. In a preferred embodiment, calls established between
10 mobile communications network 106 and communications devices 110 are not broken if mobile telephone 104 is then removed from docking unit 102. Rather, the connection is maintained and the user may continue the call using mobile telephone 104 without interruption. For example, assume that a user establishes a call from home using a POT attached to docking unit 102, but then
15 has to leave home before the call has ended. The user can simply pick up mobile telephone 104 and continue the call without interruption.

FIG. 2 depicts docking unit 102 and mobile telephone 104 in greater detail. Docking unit 102 includes a conversion module 202 and a BORSCHT module 204, both connected between serial port 112 and two-wire line port 116.
20 Mobile telephone 104 includes a controller 206, a radio unit 208, and an antenna 210. Controller 206 and radio unit 208 are connected to docking unit via serial port 114, and radio unit 208 is connected to antenna 210.

Conversion module 202 converts the digital signals received over serial port 112 into two-wire signals recognizable to communications device 110.
25 Conversion module 202 also performs the reverse conversion, that is, from two-wire signals into digital signals. These conversions are well known to those skilled in the art.

BORSCHT module 204 provides BORSCHT functionality for communications devices 110. As described above, BORSCHT functionality is
30 defined as those functions provided by a wireline telephone service to an attached communications device, and may vary somewhat depending upon the particular wireline service. For example, BORSCHT module 204 might sense when the handset of a POT connected to two-wire line port 116 is picked up, and then provide a dial tone or light the keypad.

Conversion module 202 and BORSCHT module 204 are described in terms of the functions they provide. Those skilled in the art will recognize that many conventional approaches exist for implementing this functionality, including computer hardware, software, or a combination of both. In a preferred embodiment, both functional modules are implemented using a digital signal processor (DSP), a memory, and software routines to control the hardware. Other alternative embodiments might consist entirely of hardware, or different combinations of hardware and software.

Turning now to mobile telephone 104, controller 206 represents the hardware, software, or combination of both hardware and software that controls the functions of mobile telephone 104. Those skilled in the art will recognize that the particular design of controller 206 can vary from one phone to the next. For purposes of this description, only the BORSCHT functionality provided by controller 206 is of interest. Radio unit 206 and antenna 208 provide the capability of transmitting signals over wireless link 108 to mobile communications network 106. Again, many conventional designs of radio unit 206 and antenna 208 are known within the relevant art.

Different mobile telephones 104 provide more or less BORSCHT functionality. For instance, mobile telephone 104 may not provide any BORSCHT functionality, in which case BORSCHT module 204 must provide all the BORSCHT functionality for wireline-like service to communications devices 110. In a preferred embodiment, mobile telephone 104 provides dial tone and call origination, and BORSCHT module 204 provides the remaining wireline functionality.

Conclusion

While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

The previous description of the preferred embodiments is provided to enable any person skilled in the art to make or use the present invention. While

the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

5

WHAT IS CLAIMED IS:

CLAIMS

1. An apparatus for connecting an analog communications device to a
mobile communications network using a mobile telephone, comprising:
BORSCHT means for providing BORSCHT functionality;
a serial interface coupled to said BORSCHT means for connecting the
mobile telephone to said BORSCHT means;
a two-wire line port coupled to said BORSCHT means for connecting the
analog communications device to said BORSCHT means to emulate wireline
communications service; and
conversion means coupled between said serial interface and said two-
wire line port for converting analog signals from the analog communications
device into digital signals, and for converting digital signals from the mobile
telephone into two-wire line signals;
wherein, when the mobile telephone is connected to said serial interface
and the communications device is connected to said two-wire line port, the
communications device can place and receive calls over the mobile
communications network.
2. The apparatus of claim 1, wherein the mobile communications network
comprises a code division multiple access (CDMA) cellular communications
network.
3. The apparatus of claim 1, wherein said BORSCHT functionality
comprises dial tone and call origination.
4. The apparatus of claim 1, wherein the mobile telephone provides
BORSCHT functionality different from the BORSCHT functionality provided by
said BORSCHT means.
5. The apparatus of claim 4, wherein the BORSCHT functionality provided
by the mobile telephone comprises dial tone and call origination.

6. An apparatus for connecting a plurality of analog communications devices to a mobile communications network using a mobile telephone, comprising:

BORSCHT means for providing BORSCHT functionality;

a serial interface coupled to said BORSCHT means for connecting the mobile telephone to said BORSCHT means;

a plurality of two-wire line ports, one for each analog communications device, each coupled to said BORSCHT means for connecting the associated analog communications device to said BORSCHT means to emulate wireline communications service; and

conversion means coupled between said serial interface and said two-wire line port for converting analog signals from any one of the analog communications devices into digital signals, and for converting digital signals from the mobile telephone into two-wire line signals;

wherein, when the mobile telephone is connected to said serial interface and the communications devices are each connected to the associated two-wire line port, the communications devices can place and receive calls over the mobile communications network.

7. The apparatus of claim 6, wherein one of the communications devices comprises a plain old telephone (POT).

8. The apparatus of claim 7, wherein one of the communications devices comprises a fax machine.

9. The apparatus of claim 8, wherein one of the communications devices comprises a computer modem.

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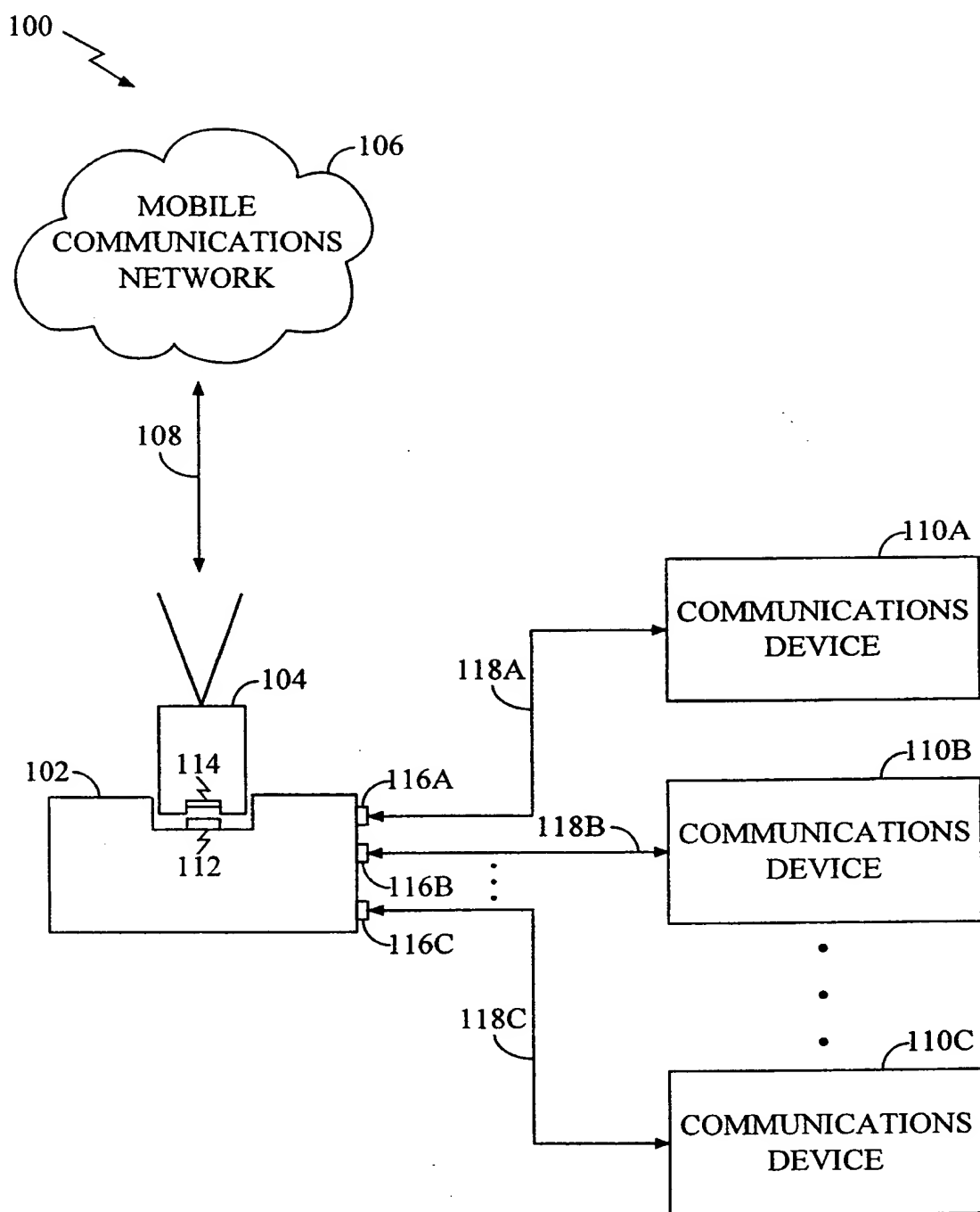


FIG. 1

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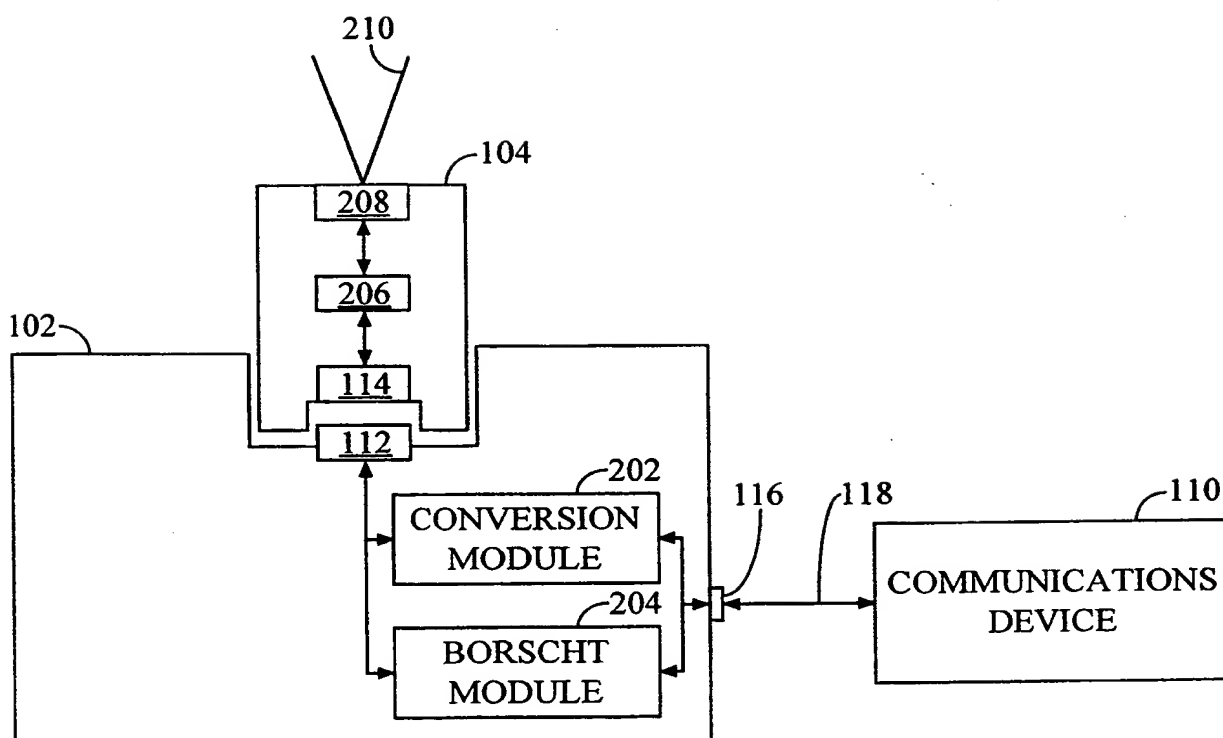


FIG. 2

PCT

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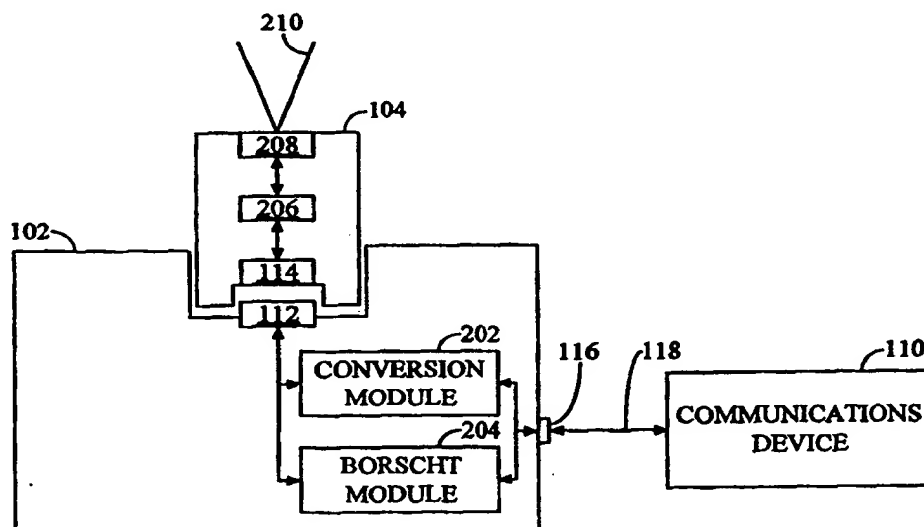
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(57) Abstract

An apparatus (102, 104) for connecting communications devices (110) to a mobile communications network (106) using a mobile telephone (104). A serial interface (112, 114) couples the mobile telephone (104) to BORSCHT means (204) that provides BORSCHT functionality. A two-wire line port (116) couples the BORSCHT means (204) to an analog communications device (110), such as a POT, a fax machine, or a computer modem. Conversion means (202), coupled between the two-wire line port (116) and the serial interface (112, 114), converts the digital signals from the mobile telephone into two-wire line signals, and vice versa. The communications device (110) can then place or receive a call over the mobile communications network (106), using the mobile telephone's radio unit (208) to establish a wireless connection, in the same manner as if the communications device were connected to a wireline service.

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